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1 September 1955

First Progress Report to Operations Coordinating Board
by
Broadcast Evaluation Section
established under paragraph 8a of
NSC-169

CENTRAL INTELLIGENCE AGENCY
Office of Scientific Intelligence

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I. Summary

A. The significance of the technical effectiveness of U.S. controlled international broadcasting to the national security and the importance of determining the degree of effectiveness for policy-making purposes has been recognized at the government level and is set forth in NSC-169, paragraph 8 (a). The problem of determining technical (signal) effectiveness of broadcasting within areas to which access is generally denied or at least limited and against which broadcast jamming and related activities are directed is unprecedented. Methods and techniques used in making such evaluations of commercial broadcasting are entirely inapplicable to this problem. New methods and new approaches have had to be evolved and are still in the process of evolution.

B. The Broadcast Evaluation Section was established under paragraph 8 (a), NSC-169, by CIA in conjunction with the Department of State, the Department of Defense, and USIA, and under the coordination of the Operations Coordinating Board, for intelligence evaluation of information concerning the technical effectiveness of U.S. International Broadcasting, particularly to the Soviet Bloc.

C. The purpose of this report is to provide information on the activities of the Broadcast Evaluation Section, CIA, since its establishment in January 1954; to provide information on problems encountered and studies undertaken with respect thereto; to provide information of assistance in interpreting statistical data presented in reports of the Broadcast Evaluation Section; to appraise future possibilities and limitations of the task; and to provide a general estimate of the technical effectiveness of U.S. international broadcasting (See Part II).

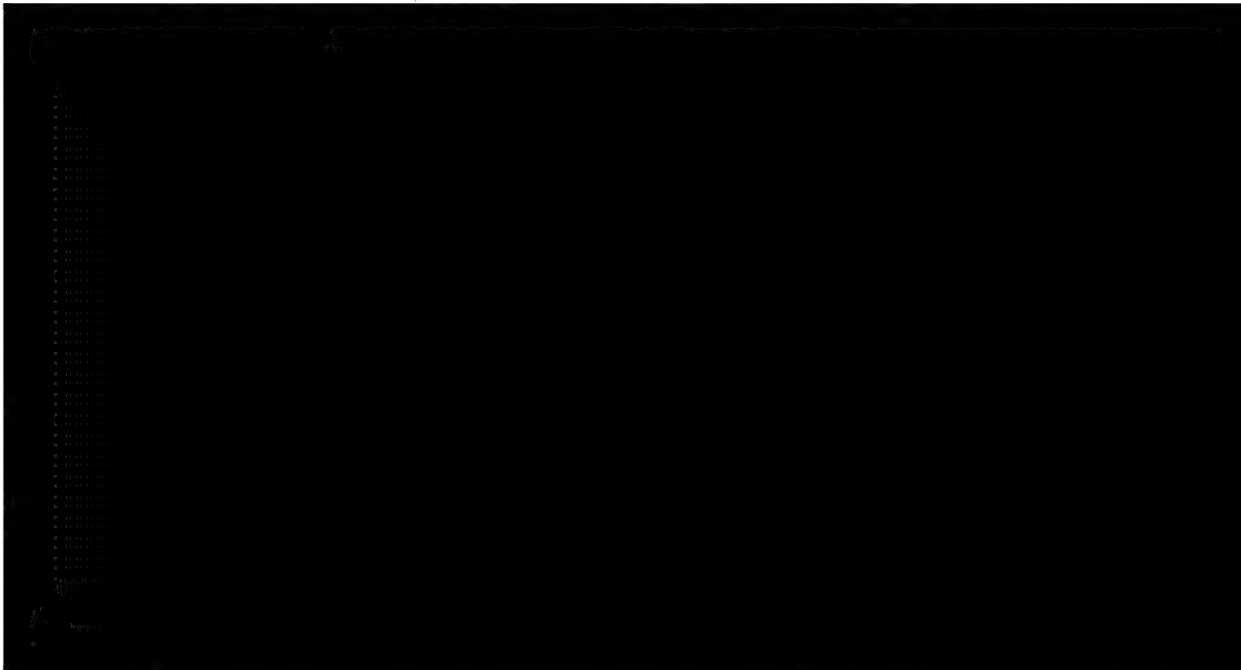
D. The organization and staff pattern of the Broadcast Evaluation Section was planned by CIA with the advice of USIA and the Departments of State and Defense.

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E. A Technical Evaluation Advisory Committee (TEAC) of technically qualified representatives of CIA, the Department of Defense, USIA, and the Department of State was provided for to advise concerning methods, standards, priorities, etc. This Committee was organized on 27 January 1954.

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H. The first problem encountered in evaluating the technical effectiveness of the three broadcasting organizations was standardization of reporting methods. Agreement was reached on the definitions of good, fair, poor, and nil intelligibility. For most analyses, "good" and "fair" are lumped as Satisfactory, and "poor" and "nil" are lumped as Unsatisfactory.

I. The problem of developing a method of summarizing and presenting the considerable quantity of data was given to a private consulting firm. Their recommendation, approved by TEAC, has been used. No single measure of technical efficiency was found which would be completely satisfactory and two measures are currently used. The "program effectiveness" is a measure of how many days a program was intelligible during the month on at least one frequency regardless of how many frequencies the program was transmitted on simultaneously. The "channel time effectiveness" reports the per cent of intelligible reception for observations of a particular program on all frequencies used and for all days of the reporting period. Monthly reports have been issued beginning with October 1954 using these measures.

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J. Conclusions drawn from statistical analysis of monitors' observations must be viewed with caution and understanding. The "significance of the sample", that is the individual monitoring intercept is not known as yet with respect to a great many factors; and, therefore, any conclusions drawn from such data must be viewed as tentative and with a background of full understanding of the circumstances and conditions under which the intercept was made and the process of analysis applied to the data.

K. Some of these variable factors are listed below.

1. Monitor's judgment of intelligibility: Since the judgment of intelligibility by a monitor is largely subjective, what is "good" to one man may sometimes be "poor" to another. To what extent this variable factor affects the final evaluation is not known at this time. However, to minimize this error, standard tapes have been prepared in four principle languages with samples of intelligibility rated good, fair, poor, and nil by the consensus of a panel of linguists. Copies of these tapes will be furnished to the monitors for use in standardizing their judgment. A seminar for monitors was held [REDACTED] during July 1955 for the purpose of setting standards of reporting and monitoring procedure. Study is being given to possible methods of separately measuring signal and jammer interference and relating these values directly to intelligibility as a means of reducing the range of operator judgment and thereby getting more objective data.

2. Frequency and duration of sampling observations: A monitor cannot listen to a whole program. He must check the same program on a number of frequencies and often check a number of simultaneous programs, each on a number of frequencies. The length of the sample, that is the time of observation, is of great importance. Since the jammer operations are ever changing, the significance from a statistical standpoint becomes very great. Study is being given to the optimum period of monitoring by an engineering consultant based on special test recordings of broadcast reception.

3. Receiving equipment used in monitoring: Study has indicated that there is no such thing as a "typical indigenous receiver." The variables of design, state of adjustment, type of antenna, etc., introduce wide variables. It has been found desirable to use a precision receiver whose characteristics and sensitivity are precisely known and can be standardized and to cross-check this against the nearest thing to a "typical indigenous receiver."

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4. Area of validity of observations made at one particular location: Perhaps the most significant problem not yet satisfactorily answered is the determination of how far from the monitoring post the observations may be considered representative of reception conditions. It appears likely that no general rule applies and the area of validity varies from case to case. Certainly the area of validity is small in cases involving jamming signals from near-by transmitters, i.e., signals transmitted by ground wave.

L. It has been suggested that a study of the basic factors involved in intelligibility might indicate methods of improving the intelligibility and better methods of observing and evaluating the intelligibility. No work on this suggestion has yet been done.

M. So far, analysis of monitor reports has been by program, that is, language and time of day. Some investigation has been made as to variation with frequency and transmitter location. No investigation has yet been made to variation with respect to type of program broadcast. Special methods of analysis applicable to standard band and long wave signals may be fruitful, but the matter has not yet been fully investigated.

N. Therefore, it may be seen that, although the organization has been established, procedures put into effect, a staff recruited and trained, and data flow initiated, results to date must generally be considered as tentative and subject to many qualifications. Progress has been and is being made in narrowing the probable limits of error and sharpening the significance of the conclusions derived from statistical treatment of monitoring data.

II. Technical Effectiveness of U.S. International Broadcasting

A. It is estimated that, in spite of the effort put into the jamming of U.S. international broadcasting, the effect of the jamming varies widely with frequency band, geographic location, and target language; and the programs are frequently reaching wide sections of the target areas.

B. In the following paragraphs, a selection of more particular conclusions is presented. This may serve to indicate the kind of answers which the Broadcast Evaluation Section is prepared to make to specific questions. No attempt is made to arrive at conclusions regarding all possible details in view of the many variables of time, frequency, location, and language involved and the differing reliability of information concerning them. Sampling of reception conditions in the target area is extremely meagre both in time and space. The sampling on the periphery, while probably adequate in time, is subject to some question as to the geographic extent of

its applicability. Moreover, the Broadcast Evaluation Section has investigated available information regarding medium and low frequencies only with respect to a few specific questions. For these reasons, conclusions are labelled estimates. It is expected that where more reporting from within the target area becomes available, the above general conclusions will be confirmed, although estimates as to the detailed situation may be modified and extended.

C. With respect to frequency band, as a generalization, high frequency broadcasting is the most effective. The effectiveness indexes computed from the observations by the peripheral monitors and summarized in the monthly reports indicate that even Russian language programs -- which receive the greatest attention by the jammers -- are frequently receivable.*

*For example, the summary report for the four winter months, November 1954 through February 1955, shows channel effectiveness (per cent of total observations which were classified as intelligible) for one or more monitoring locations as follows:

<u>Program</u>	<u>Channel Effectiveness</u>
VOA - Armenian	13
VOA - Russian	17
VOA - Ukrainian	20
VOA - Georgian	25
VOA - Latvian	31
VOA - Hungarian	37
VOA - Estonian	38
VOA - Lithuanian	43
VOA - Polish	43
VOA - Czech-Slovak	44
VOA - Rumanian	45

(These figures cannot be taken too literally since they are based on subjective observations by a number of individuals using equipment and procedures not completely standardized and since it is as yet uncertain how far into the target areas observations made on the periphery can be applied. Nevertheless, it is believed that the figures are generally indicative of the situation in adjacent Bloc territory in the absence of local [ground wave] jammers.) Poor reception is largely, but not entirely, a reflection of the effect of the Soviet jamming effort; some of the poor reception reported is due to vagaries of sky-wave propagation and other causes.

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D. These reports also indicate that programs in languages of the USSR are generally less frequently intelligible than programs in Satellite languages. Persian and Turkish are the only non-Bloc languages that are consistently jammed. Some jamming has recently occurred on German language programs directed to Austria.

E. There is certainly a considerable geographic variation over long distances where reception of the broadcast and jamming signals are by sky waves. This is apparent from considerations of the broadcast antenna patterns and high frequency propagation variations taken together with knowledge of the locations of the jammers used and is confirmed by the variation between the reports of peripheral monitors.*

F. In addition to this large area variation, there exist relatively small areas near jamming stations where steady ground wave signals, not subject to the vagaries of sky-wave propagation, will succeed in jamming a high frequency program whenever the jammer is on the frequency. From time to time, reports from observers in the target areas have given us the location of some of these local jamming areas. A number of reports from Moscow state that high frequency broadcasts are consistently jammed** and indications are that the jamming transmitters are located in the Moscow area.

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*For example, the channel effectiveness of VOA Polish programs during the four winter months as observed at different places were as follows:

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- 41
- 51
- 35
- 39

An even more extreme example is the case of VOA Russian language programs which are as follows:

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- 21
- 22
- 2
- 19

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While three locations showed remarkably consistent results, found only 35 intelligible samples out of a total of 1871.

**e.g., on twenty-four days during March 1955, the embassy in Moscow monitored 324 VOA Russian language transmissions and 87 transmissions of Radio Liberation. VOA was heard with good intelligibility on two occasions; Radio Liberation was not heard.

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H. A review of the program and channel effectiveness statistics for July 1954 and from October 1954 through March 1955 revealed few trends to indicate major changes in Communist high frequency jamming activities during this period. A large portion of the variations noted could be accounted for by seasonal variations in propagation conditions. However, jamming of VOA Georgian, Armenian, and Ukrainian increased; and regular jamming of VOA Persian and Turkish language programs began.

I. As a rule, reception on the higher high-frequency broadcast bands (15 and 17 mc.) is more often intelligible than on the lower bands.

J. The investigation of medium frequency broadcasting has been carried forward by the Broadcast Evaluation Section only with respect to a few specific projects.

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2. It is apparent that medium wave reception is usually impossible in most areas of Czechoslovakia. A member of the U.S. Embassy staff indicates that "medium frequencies are not

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heard except when the jammers have apparently broken down." This comment was said to apply both to RFE (719 and 854 kc.) and VOA (1196 kc.) broadcasts. At the same time, the VOA [REDACTED] report that the VOA Czech medium frequency programs are frequently (25 to 50% of the observations) intelligible at that location.

3. Few other reports have been received from within other target areas concerning medium wave reception. Reports of the peripheral monitors indicate the possibility of a wide range of intelligibility in different target areas. Jamming signals are observed on the MF transmissions of VOA in the Far East, including programs directed to China, but the extent and effectiveness of the jamming has not been determined.

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K. No investigation has been made of the coverage of the VOA broadcasts on long wave (173 kc.), although reports of peripheral monitors are included in the machine files of the Section. The [REDACTED]

intelligible reception of VOA programs on 173 kc. cannot be expected at any time. This condition applies no matter what the language of the broadcast.

III. Chronology

A. Authorization by NSC-169. The responsibility for establishment of the Broadcasting Evaluation Mechanism was assigned to CIA by NSC-169 on 27 October 1953. Plannings for the organization required for this mechanism were immediately undertaken, and the creation of a Broadcast Evaluation Section in the Office of Scientific Intelligence was confirmed by official Agency action on 6 March 1954.

B. Planning. The plan for the Broadcast Evaluation Section was drafted with the cooperation and advice of representatives of USIA, State, and Defense. It proposed a staff of six technical personnel and two clerical. The object was defined as follows: "To assist top policy officers of this Government in determining the desirable extent and nature of American official and unofficial broadcasting operations, particularly to the Soviet bloc, in the light of Soviet countermeasures, as well as economic, military, and psychological factors, by providing a means of collating information from all sources on the effectiveness of each of the several broadcasting efforts in aspects other than program content." The plan provided that in its operation, the Section is to avoid duplication of effort by other organizations and to make use of the facilities of other organizations as far as feasible.

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C. Staff of the Broadcast Evaluation Section. Staffing of the six technical positions of the Broadcast Evaluation Section proved difficult because of the rather specialized experience which was sought in prospective employees. A Section Chief was recruited by 14 March 1954, two additional personnel were transferred from within the Agency in November and December, two more were cleared and assigned in March and May 1955, and the sixth analyst is currently being cleared. Experience of these employees includes broadcast station design and operation, radio parts manufacturing, teaching of radio subjects, radio wave propagation analysis and mathematics, including statistical analysis. It is considered that each of these varied backgrounds will contribute to making a strong evaluation team.

D. TEAC. An advisory committee of technically qualified representatives of the Department of Defense, USIA, and Department of State was specified to advise concerning methods, standards, priorities, etc. This committee was organized on 27 January 1954. It is called the Technical Evaluation Advisory Committee (TEAC) for International Broadcasting. Its charter was approved by the Department of Defense, USIA, and the Department of State. It has met fifteen times for the purpose of approval of evaluation methods, planning special tests, improvement of reporting procedures, etc.

E. Sources of information. The source of raw material for the evaluation has been primarily the reports of technically-trained observers established by the cooperating agencies in a number of peripheral locations. This is supplemented occasionally by observers in U.S. missions in the European Soviet Bloc countries. (For an account of [REDACTED] see paragraph III G below.) In addition, information concerning effectiveness is obtained from [REDACTED]

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Peripheral monitoring stations (some part-time operations, some with three or more observers) currently submit observations as follows:

ORGANIZATION

VOA

APPROXIMATE NUMBER
OF REPORTS PER MONTH

10,000
8,000
7,000
5,000
6,000
2,500

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	<u>ORGANIZATION</u>	<u>APPROXIMATE NUMBER OF REPORTS PER MONTH</u>
25X1A	RFE	11,000 5,000 14,000
25X1A	RL	700 100 300 300

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It will be noted that while there are many reporting locations peripheral to the European Bloc area, there are only two at present in [REDACTED]

F. IBM machine processing. It was initially intended that the voluminous observations by the peripheral monitors, which was to be the basis of statistical reports, would be given a preliminary summation by the contributing organization and that the Broadcast Evaluation Section would combine and evaluate these. However, it quickly became apparent that the quantity of data and the number of ways of analyzing them was such that a centralized machine file system was necessary. Accordingly, with the approval of TEAC, the Broadcast Evaluation Section arranged to receive the raw reports from the monitors, put the data from each observation on an IBM card, and use sorting machinery to determine the statistics to be reported. This was first applied to the analysis of [REDACTED] data (see next paragraph) and to the first monthly report covering October observations. Monthly summaries have been published since then with a winter season summary (for November through February) incorporated in the February report. To mechanize the process still further, arrangements are currently being made to purchase teleprinter machines with tape perforators for use by certain peripheral monitors. The information typed by the monitor will then appear on the teletype tape which can be forwarded to Washington for automatic punching of the IBM cards.

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H. Methodology development. The first problem encountered in evaluating the technical effectiveness of the three broadcasting organizations was to standardize on a reporting method. Two organizations reported five grades of intelligibility and the other used four. By agreement, all three adopted four grades with definitions as follows:

- Good - good intelligibility is defined as easily understood.
- Fair - fair intelligibility is defined as understandable, but with difficulty because of interference or other causes.
- Poor - poor intelligibility is defined as not being understandable because of interference or other causes.
- Nil - nil means no reception at all because of interference or other causes.

In analysis, this is usually further simplified by lumping the first two as satisfactory and the second two as unsatisfactory. The next problem confronting the Broadcast Evaluation Section after organization was to develop a method of summarizing and presenting the considerable quantity of data being furnished by the peripheral monitors. The task was given to a consulting engineering firm, an organization with considerable experience in monitoring procedures including the problem of monitoring Soviet jamming signals. Their recommendation of the use of two figures was accepted by TEAC and has been used in the monthly reports. These figures labelled "cumulative program effectiveness" and "channel time effectiveness" are defined in the preface of each report since they have a very special meaning. (It is important to understand the method of

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derivation of these figures in order to have the proper assessment of their meaning; they are discussed in more detail in Section V A of this report.) The consultant firm also reviewed in a preliminary way some of the problems and uncertainties in the evaluation procedure. These are also discussed in some detail in Section IV. One of the problems is the question of the optimum length of a monitoring sample; i.e., how long should the observer listen to a particular frequency to be able to decide with reasonable accuracy the technical effectiveness of the program, i.e., how long and how often should an observer listen to a particular frequency in order to make best use of his monitoring time and obtain reasonably accurate monthly figures of technical effectiveness. A radio engineering consultant of Washington has been employed to analyze special test recordings of broadcast reception with a view to determining the degree of accuracy which would result from observations of various durations and occurring at various points of the program. This study is currently in progress. Other problems of methodology discussed below, both in monitoring and reporting, have received tentative answers; others are yet to be investigated.

IV. Problems of Technique

A. Problems of reporting.

1. Standardization of intelligibility grading. As indicated above, the cooperating organizations all now use similar reporting forms with the same definitions of intelligibility. However, this grading is necessarily a matter of simple judgment by the monitor; and experiments to date indicate that two persons listening to the same program and provided with the same definitions of grades of intelligibility will frequently disagree, particularly when the program is partly degraded and not certainly "good" or "nil." It is not known how much of an error in the final evaluation is introduced by this variable. However, in an effort to minimize the problem, tapes have been prepared in four principal languages (Russian, Polish, Czech, and Hungarian) with samples of intelligibility rated good, fair, poor, and nil by the consensus of a group of linguists. Copies of these tapes will be furnished to the monitors to use in standardizing their judgment. They were also used to test the variation in present judgment between those monitors who attended a seminar on monitoring procedures conducted by the Broadcast Evaluation Section with the cooperation of the VOA, RFE, and Radio Liberation [redacted] during July 1955.

2. Standardization of equipment. The effect of jamming on a particular program can vary with variation in certain receiver characteristics. These characteristics in home broadcast receivers can vary widely depending on the design and state of adjustment. Some antennas will often have some

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directional properties which might favor either the program or the jammer. Some monitors have endeavored to simulate home installations by the use of an indigenous receiver and a "typical" antenna. However, recognizing that any particular home receiver may or may not be typical and a stable well-made communications type receiver adjusted to simulate an average home receiver is more apt to give consistent results, most monitors now use the Collins 51J3 receiver at maximum band-width setting. It still remains to make certain that this adjustment in fact approximates reception on a home-type set and that receivers at different stations will give consistent results. Also, with respect to antennas, standardization has been recommended on a vertical whip which is least likely to have directional properties; and as soon as feasible, will be universally applied.

3. Standardization of monitoring procedures. The length of time of observations, i.e., the sample, by a monitor is necessarily less than the length of the program since it is desired to check not one but all the frequencies used for the program and to check other programs which may be transmitted at the same period and receivable at the monitoring station. This may for some cases require listening to twenty or more frequencies in the course of a half hour and, if this is to be done by one operator, he obviously cannot listen very long on any one frequency. Since the intelligibility may vary considerably in a short time during the course of a program because of the shifting pattern of jammer operations or changes in radio wave propagation conditions, this necessity for sampling introduces an unknown variable in the monitoring results. As mentioned in paragraph III H above, a test continuous recording of a particular - and presumably typical - program as received at five monitoring stations for a period of two days is currently being analyzed to determine the deviation in reported intelligibility which would result from sampling in different ways. It is expected that recommendations can be made as to the optimum period of listening.

All operators are instructed to "tune for the best intelligibility", and it is believed that possible variations in grading due to tuning procedure are minimized.


Problems of operator judgment would be eliminated if a procedure could be devised to measure the field intensity of the signal and of the interference (or their ratio) and relate these in some standard way to intelligibility. This approach is under investigation. It is not yet clear whether a practical solution will be obtained.

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B. Problems of evaluation.

1. Statistics with different bases. So far, analysis of monitor reports has been by "program", i.e., language and time of day. Some investigation has been made as to variation with frequency and with transmitter location as machine processing and analysts' time permits. No investigation has yet been made as to variation with respect to type of program broadcast.

2. Special methods of analysis applicable particularly to MF and LF signals will probably be fruitful, but the question has not yet been fully investigated. The situation differs from that on high frequencies in that only a few frequencies are used; and in general, the pattern of broadcasting and jamming is stable.



3. Basic intelligibility factors. It has been suggested that a study of the basic factors involved in intelligibility might indicate

a. methods of improving the intelligibility of reception in the target areas.

b. better methods of observing and evaluating the intelligibility.

Action on this suggestion awaits the completion of more pressing problems.

V. Interpretation of Monitors' Reports

The approach thus far used by the Broadcast Evaluation Section in statistical analysis of the peripheral monitors' observations yields figures which must be used with understanding (their meaning is not simply apparent) and caution (there are a number of variables in addition to those listed in Section IV A, whose importance is not yet fully clear).

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A. The "five figure expression" concerning a particular program or broadcast period (e.g., VOA Russian at 1415 GMT) observed over a particular period of time (e.g., the month of January) gives the following in sequence:

1. The total number of frequency units broadcast (a relative measure of the broadcasting effort).
2. The total number of frequency observations (a relative measure of the corresponding monitoring effort).
3. The total number of "good" or "fair" observations (that is, the total observations of intelligible signals).
4. The technical efficiency of cumulative program (that is, the percentage of days of the month on which the program was intelligible on at least one frequency).
5. The technical efficiency of channel time (that is, $\frac{3}{2}$ divided by $\frac{3}{2}$ expressed as a percentage).

The reason for giving two different figures on technical efficiency stems from the following considerations: In nearly all cases, the same program is transmitted simultaneously into the target area on more than one frequency. It can be argued that if at least one of the many frequencies can be received in the target area, then the reception of that program can be considered technically effective. On the other hand, if more than one can be received, it can well be argued that the reception of that program is more effective since there is a greater chance that the listener will run across one of several frequencies carrying the program in the crowded and partially jammed broadcast bands. The program effectiveness is a measure of how many days a program was intelligible during the reporting period (e.g., a particular month) on at least one frequency. The channel time effectiveness reports merely the per cent of intelligible reception for observations of a particular program on all frequencies used and for all days of the reporting period. The latter figure may be unduly pessimistic as a measure of how often a program is receivable, but the former may be somewhat optimistic, particularly if it derives from the case of only one out of many frequencies getting through.

B. Variables in the procedure which are recognized but have been only partly evaluated are:

1. A monitor may at times check and report on frequencies which are not beamed in his direction, even though beamed to the target area proper. While he may nevertheless hear the signal because of "minor lobes" of directional antennas and

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vagaries of radio waves, the liklihood is, of course, much less than if he is "on the beam." Operational procedures have not yet been established to account for this which may in some cases depress the reported technical effectiveness.

2. The monitor may be "on the beam" of the broadcast signal but not receiving jamming to the same degree as the target area. Several attempts have been made to evaluate the importance of this and, so far, they have been inconclusive. It certainly is important when jamming in the target area occurs from near-by (ground wave) jammers. Simultaneous observations at two different locations of distant (sky wave) jamming signals on a certain channel often indicate that the predominant jammer at one place at any instant is different from the predominant jammer at the other. Whether this means that over an extended period of observation the intelligibility of the jammed signal would not correlate is not certain, and tests generally have been inconclusive because of insufficiency of samples or other variables (such as local jammers or unskilled reporters).

3. While it is apparent that repetition of programs at different times during the day will improve the chances of that program getting through, no attempt has been made to take this factor into account in the reports of the Broadcast Evaluation Section.